

Warm-up!

1. Factor

$$2x^3 + 3x^2 - 8x - 12$$

2. Simplify  $\sqrt[4]{32a^8b^5c^{10}}$ 3. Simplify  $\sqrt{\frac{a^2}{16}}$ 

## 5.6 Radical Expressions

Properties

$$a, b, \sqrt[n]{a}, \sqrt[n]{b} \in \mathcal{R}$$

$$m, n \in \mathbb{Z}$$

1.  $\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$

2.  $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

3.  $\sqrt[n]{b^m} = (\sqrt[n]{b})^m$

4.  $\sqrt[m]{\sqrt[n]{b}} = \sqrt[mn]{b} = \sqrt[n]{\sqrt[m]{b}}$

Ex:

$$\sqrt{36} = \sqrt{9 \cdot 4} = 3 \cdot 2 = 6$$

$$\sqrt{4^3} = \sqrt{4^3} = 2^3 = 8$$

$$\sqrt[8]{16} = \sqrt[8]{16} = \sqrt[4]{4} = \sqrt{\sqrt{4}} = \sqrt{2}$$

Ex:

$$\sqrt[3]{8^2} = \sqrt[3]{8^2} = 2^2 = 4$$

$$\sqrt[3]{216} = 6$$

$$\sqrt[6]{64} = \sqrt[6]{64} = \sqrt[3]{8} = 2$$

Ex:

$$\sqrt[5]{32} = \sqrt[5]{32} = \sqrt[5]{2^5} = 2$$

$$\sqrt{\frac{7}{4}} = \frac{\sqrt{7}}{\sqrt{4}} = \frac{\sqrt{7}}{2}$$

Rationalize the Denominator  
(free of irrational numbers)

$$\sqrt{\frac{7}{3}} = \frac{\sqrt{7}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{21}}{3}$$

$$\frac{9}{\sqrt{b^3}} = \frac{9}{b\sqrt{b}} \cdot \frac{\sqrt{b}}{\sqrt{b}} = \frac{9\sqrt{b}}{b^2}$$

$$\frac{4}{\sqrt[4]{27a^2}} = \frac{4}{\sqrt[4]{3^3 a^2}} \cdot \frac{\sqrt[4]{3a^2}}{\sqrt[4]{3a^2}} = \frac{4\sqrt[4]{3a^2}}{\sqrt[4]{3^4 a^4}} = \frac{4\sqrt[4]{3a^2}}{3a}$$

$$\frac{2}{\sqrt[5]{2c^4}} \cdot \frac{\sqrt[5]{2^4 c}}{\sqrt[5]{2^4 c}} = \frac{\cancel{2} \sqrt[5]{2^4 c}}{\cancel{2} c} = \frac{\sqrt[5]{16c}}{c}$$

$$\frac{1}{\sqrt[5]{a^2 b^3 c}}$$

$$\frac{8}{\sqrt[3]{32ab^2c^6}} = \frac{8}{2^5 \sqrt[3]{2ab^2c^6}} = \frac{2}{2c^2 \sqrt[3]{2ab^2}} \cdot \frac{\sqrt[3]{2a^2b}}{\sqrt[3]{2a^2b}} = \frac{2\sqrt[3]{2a^2b}}{2c^2 \cdot 2ab} = \frac{2\sqrt[3]{2a^2b}}{4abc^2}$$

$$\frac{1}{\sqrt[3]{48}}$$

Operations (combine like terms)

ex:

$$\sqrt{50} - 3\sqrt[3]{72} + \sqrt[3]{8}$$

$$5\sqrt{2} - 18\sqrt{2} + 2$$

$$-13\sqrt{2} + 2$$

ex:

$$\sqrt{8} + \sqrt{98}$$

ex:

$$\sqrt[3]{81} - \sqrt[3]{24}$$

$\sqrt[3]{3^4} \quad \sqrt[3]{2^3 \cdot 3}$

$$3\sqrt[3]{3} - 2\sqrt[3]{3}$$

$\sqrt[3]{3}$

$$\frac{24}{3}$$

ex:

$$(\sqrt{3} - \sqrt{5})^2$$

$$(\sqrt{3} - \sqrt{5})(\sqrt{3} - \sqrt{5})$$

$$3 - \sqrt{15} - \sqrt{15} + 5$$

$8 - 2\sqrt{15}$

ex:

$$(\sqrt{7} - \sqrt{11})(\sqrt{7} + \sqrt{11})$$

$7 - 11$

$-4$

ex:

Conjugates

$$\frac{1}{(3 + \sqrt{2})(3 - \sqrt{2})}$$

$$= \frac{3 - \sqrt{2}}{9 - 2} = \frac{3 - \sqrt{2}}{7}$$

ex: Conjugates  $a + b$  and  $a - b$ 

$$\frac{8}{4 - \sqrt{5}}$$